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# EXPORTS AND ECONOMIC GROWTH: A SECTORAL ANALYSIS FOR TURKEY

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## Abstract

The aim of this study is to examine the relationship between exports and the industrial production index for economic growth by employing the Granger causality test for the total manufacturing sector and Turkey's top 10 exported goods over the period 2002:01 to 2012:05. According to our findings, there is evidence to support export-led growth for basic metals, chemical products, and fabricated metal products in the long-run and a unidirectional causality relationship was found from economic growth to exports for electrical machinery and apparatus both in the short and long-run. Moreover, a pattern of growth-led exports is also valid for chemical products in the short-run.

**Key Words:** *Export-led growth, Granger causality test, Manufacturing sectors*

**JEL Classification:** F43, F14, C22, L60

## 1. INTRODUCTION

After World War II, governments applied restrictive trade policies which are widely known as the import substitution industrialization strategy. After this period, the bias shifted towards an export promotion strategy. International trade causes an increase in productivity due to economies of scale and increase in competition (Helpman and Krugman, 1985; Balassa, 1978). New technologies also spread instantly and capital and intermediate goods can flow freely among trading partners. These externalities result in an increase in production (Grossman and Helpman, 1991; McKinnon, 1964). It is widely argued that exporting firms easily adopt new technologies, experience advantageous economies of scale and increase their efficiency due to increased foreign competition. As a result, an

increase in exports leads to an increase in production which is known in literature as export-led growth.

Recent empirical literature analyzes whether export growth contributes positively to economic growth or not. Some studies, like Hossain and Krunaratne (2001), Bhattachayya (2001) and Njikam (2003), investigated the causality relationship between growth and specific kinds of export sectors. The aim of these studies is to detect productivity and technology differences between each trading sector. For instance, Bhattacharyya (2001) showed that export composition is changing in favor of manufacturing sectors and found that technology based products' export share is increasing in the total manufacturing sectors. Chow (1987) found bi-directional causality between output and export growth in most of the newly industrialized countries. Njikam (2003) tested the export-led growth hypothesis for the manufacturing and agricultural sectors' of 21 Sub Saharan countries. During the export promotion period, 9 of the 21 countries' agricultural exports and 3 of the 21 countries' manufactured exports uni-directly caused economic growth. Hossain and Krunaratne's (2001) studies found a long run and positive relationship between expansion of exports and economic growth in Bangladesh for the period from 1974 to 1999. Results showed that rather than manufacturing exports, total exports are the main engine of growth. AbuQuarn and Abubader (2001) studied 9 Middle East and MENA (North Africa) countries. Their study mentioned the importance of shares of manufactured exports in total merchandise exports. As the share of manufacturing exports increases, there is a bi-directional causality between exports and economic growth. Saatçioğlu and Karaca (2004) studied Turkey's export growth relationship for two sample periods. While there is no causality relationship for the period 1950-1980, they found that exports cause growth for the period between 1981 and 2000. Kösekahyaoglu (2006) also confirmed this result. Bilgin and Şahbaz (2009) used the Industrial Production index for the Proxy of GDP. Results showed a one way causality relationship from exports to growth. Export-led growth was verified for the period from 1987 to 2007. Halıcıoğlu (2007) also found uni-directional causality from exports to industrial production for Turkey from 1980 to 2005. Taban and Aktar (2008) investigated the export-led growth hypothesis for Turkey from the period between 1980 and 2007 and Kızılgöl (2006) studied the export and tourism-led growth hypothesis for Turkey from the period of 1963-2005. Both studies supported the hypothesis that economic growth is based on export growth in the case of Turkey. Çetintaş and Barişik (2009) studied the export, import and growth relationship for 13 transition economies. While their findings support one-way causality from growth to exports, they do not support reverse causality. Çiftçioğlu and Nekhili

(2005), distinctive from other studies, investigated whether or not the relative share of each sub sector of tradable goods in GDP causes economic growth. Results showed that there is a bi-directional causality between the relative output share of manufacturing and economic growth and unidirectional causality from the relative output share of mining to economic growth.

Empirical studies based on the Granger causality show mixed and contradictory results. While economic growth can be the determinant of exports, known as "growth-led exports", the exports can be the determinant of economic growth, which is also known as "export-led growth" in the literature. Moreover, the exports and economic growth can mutually affect each other. On this basis, this study analyzes both the causality relationship between economic growth and exports of the total manufacturing industry and exports of sub-sectors of the manufacturing industry individually for Turkey. Results supported the export-led growth hypothesis for basic metals, chemical products and fabricated metal products in the long-run and for chemical products in the short-run. A uni-directional causality relationship, growth-led exports, was found for the electrical machinery and apparatus industry, both in the short and long-run.

This paper proceeds as follows: Section I describes variables and discusses the empirical findings of the model. Section II provides concluding remarks.

## 2. DATA AND EMPIRICAL ANALYSIS

Data selection of the sub-manufacturing industry sectors is based on Turkey's top ten exported goods (basic metals, chemicals and chemical products, coke, refined petroleum products and nuclear fuel, electrical machinery and apparatus n.e.c., fabricated metal products (except machinery and equipment), machinery and equipment n.e.c., motor vehicles, trailers and semi-trailers, rubber and plastics products, textiles and wearing apparel) for the time period in question. Data for the individual exports (Million U.S. Dollars) are taken from TurkStat (Turkish Statistical Institute) according to the ISIC Rev.3, level 2. The Industrial production index (IPE) is used as the proxy for economic growth. This proxy variable is also used in the following studies: Bilgin and Şahbaz (2009), Taştan (2010), Demirhan and Coşar (2012). Data for IPE are taken from the TurkStat and all values of IPE converted to the base year 2005. All variables are transformed to natural logarithms. The data period ranges from 2002:01 to 2012:05. This period, following the local economic crisis in 2001 has been chosen for its notable changes; Turkey implemented structural arrangements in many areas, particularly in the financial sector, maintained fiscal discipline, experienced a rapid decline in inflation, implemented new economic policies, switched its

fixed exchange rate regime to a floating exchange rate in February 2001, and experienced a rapid improvement in foreign exchange rates (Yükseler, 2009).

First of all, to implement the Granger causality test (Granger, 1969) all variables should be stationary. Engle and Granger (1987) state that it is necessary to take the differential of a non-stationary series to make stationary. In order to avoid the potential problem of spurious relationships and incorrect inferences, all variables are stationarized. The Augmented Dickey Fuller Test (ADF) (ADF, 1979) is used for unit root tests. The ADF test, which comprises an intercept and trend is shown in the following equation:

$$\Delta Y_t = \alpha_0 + \beta_1 t + \gamma\, Y_{t-1} + \sum_{i=1}^{k} \delta_i \Delta Y_{t-i} + \varepsilon_t \qquad (1)$$

Since data used in this study includes a monthly series, a seasonality problem existed. This problem was corrected by using the TRAMO / SEATS (T / S) method for each series individually.

**Table 1:** Augmented Dickey Fuller (ADF) Unit Root Tests[a]

| Variables | Level | First Difference |
|---|---|---|
| *IPEMANU* | -2.344[1] | -19.958[0]* |
| *XMANU* | -1.971[1] | -13.553[0]* |
| *IPEAPPAREL* | -2.134[2] | -11.828[1]* |
| *XAPPAREL* | -11.260[0]* | - |
| *IPEBMETAL* | -2.353[0] | -11.345[0]* |
| *XBMETAL* | -2.970[1] | -8.591[3]* |
| *IPECHEM* | -2.042[3] | -5.583[2]* |
| *XCHEM* | -3.086[3] | -12.107[0]* |
| *IPECOKE* | -5.101[0]* | - |
| *XCOKE* | -3.294[1]*** | - |
| *IPEELECT* | -3.041[2] | -14.292[2]* |
| *XELECT* | -1.155[2] | -13.330[1]* |
| *IPEMACHINE* | -2.013[1] | -17.728[0]* |
| *XMACHINE* | -2.331[1] | -13.462[0]* |
| *IPEBMETALPROD* | -1.633[2] | -11.252[1]* |
| *XBMETALPROD* | -2.051[2] | -7.095[1]* |
| *IPEMOTOR* | -2.599[1] | -14.429[0]* |
| *XMOTOR* | -2.379[3] | -5.196[2]* |
| *IPERUBBER* | -2.426[0] | -12.659[0]* |
| *XRUBBER* | -2.386[2] | -14.536[0]* |
| *IPETEXTILE* | -1.909[1] | -14.297[0]* |
| *XTEXTILE* | -2.482[3] | -8.380[0]* |

Note: (*), (**) and (***) indicate that the corresponding coefficient is significant at 1%, 5%, and 10% levels, respectively. The optimal lag lengths are indicated within parenthesis and determined by AIC criterion.

a. tests include trend and intercept.

The results summary of ADF tests are presented in Table 1. All series ADF test results failed to reject the null hypothesis of existence of a unit root for the data at log levels and were found stationary at their first difference I(1). The exceptions were the wearing apparel and coke sectors, which are stationary in their levels I(0). As a result, these two series were eliminated from the analysis. The existence of a long-run relationship between variables was tested using the "Johansen Cointegration Tests" (Johansen, 1988; Johansen and Juselius, 1990). The criterion suggested different lag lengths for each analysis. The results of the Johansen cointegration tests are shown in Table 2.

**Table 2: Johansen Cointegration Tests and Estimates**

| Variables | AIC | Trace Statistics | Max Statistics | Critical value 5% (trace) | Critical value 5% (max) | Results | |
|---|---|---|---|---|---|---|---|
| *IPEMANU-XMANU* | 4 | 23.060** | 20.546** | 15.41 | 14.07 | r=0, r>=1 | Cointegrated |
| | | 2.513 | 2.513 | 3.76 | 3.76 | r=1, r>=2 | |
| *IPEBMETAL-XBMETAL* | 6 | 20.952** | 17.476** | 15.41 | 14.07 | r=0, r>=1 | Cointegrated |
| | | 3.476 | 3.476 | 3.76 | 3.76 | r=1, r>=2 | |
| *IPECHEM-XCHEM* | 1 | 18.029** | 16.071** | 15.41 | 14.07 | r=0, r>=1 | Cointegrated |
| | | 1.957 | 1.957 | 3.76 | 3.76 | r=1, r>=2 | |
| *IPEELECT-XELECT* | 1 | 43.275** | 41.883 ** | 15.41 | 14.07 | r=0, r>=1 | Cointegrated |
| | | 1.391 | 1.391 | 3.76 | 3.76 | r=1, r>=2 | |
| *IPEMACHINE-XMACHINE* | 3 | 12.595 | 10.057 | 15.41 | 14.07 | r=0, r>=1 | Not-Cointegrated |
| | | 2.538 | 2.538 | 3.76 | 3.76 | r=1, r>=2 | |
| *IPEMETALPROD-XMETALPROD* | 7 | 15.872** | 12.778** | 15.41 | 14.07 | r=0, r>=1 | Cointegrated |
| | | 3.094 | 3.094 | 3.76 | 3.76 | r=1, r>=2 | |
| *IPEMOTOR-XMOTOR* | 5 | 14.125 | 8.829 | 15.41 | 14.07 | r=0, r>=1 | Not-Cointegrated |
| | | 5.296 | 5.296 | 3.76 | 3.76 | r=1, r>=2 | |
| *IPERUBBER-XRUBBER* | 3 | 10.937 | 6.961 | 15.41 | 14.07 | r=0, r>=1 | Not-Cointegrated |
| | | 3.976 | 3.976 | 3.76 | 3.76 | r=1, r>=2 | |
| *IPETEXTILE-XTEXTILE* | 6 | 12.192 | 8.141 | 15.41 | 14.07 | r=0, r>=1 | Not-Cointegrated |
| | | 4.050 | 4.050 | 3.76 | 3.76 | r=1, r>=2 | |

Note: (**) indicates that test statistics is significant at 5% level, AIC

Except for the relationship between sectoral IPE and EXPORTS of the machine, motor, rubber and plastics, and textile sectors, the null hypothesis of no cointegration is rejected by all other relationships. The existence of a cointegration relationship was found between sectors' IPE and EXPORTS for total manufacturing, basic metals, chemical products, electrical machinery and apparatus and fabricated metal products, which indicates a long-run equilibrium relationship between these series for Turkey in the aforementioned period. Following the cointegration test results, the long-run relationships between variables are given in Table 3.

**Table 3:** Long-run Relationship

| **Equations** | **t-statistics** |
|---|---|
| *IPEMANU*=0.348 *XMANU* | (-13.91)* |
| *XMANU*=2.866 *IPEMANU* | (-13.33)* |
| *IPEBMETAL*=0.266 *XBMETAL* | (-8.99)* |
| *XBMETAL*=3.751 *IPEBMETAL* | (-8.97)* |
| *IPECHEM*=0.373 *XCHEM* | (-12.15)* |
| *XCHEM*=2.679*IPECHEM* | (-12.22)* |
| *IPEELECT*=0.388 *XELECT* | (-12.10)* |
| XELECT=2.576 *IPEELECT* | (-13.94)* |
| *IPEMETALPROD*=0.550 *XMETALPROD* | (-8.15)* |
| *XMETALPROD* =1.817 *IPEMETALPROD* | (-6.49)* |

Note: (*) indicates the corresponding coefficient is significant at 1% level.

According to test results, each sector's IPE (economic growth) affected EXPORTS positively and EXPORTS affected IPE positively in the long run. All variables are found statistically significant at the 1% significance level. In the long run, the effects of economic growth on the exports are greater than each sector's exports on the economic growth. For instance, while a 1% rise in XMANU leads to an increase in IPEMANU of 0.34%, a 1% rise in IPEMANU leads to an increase in XMANU of 2.86%. In the long-run analysis, a weak exogenity test is applied to examine whether the normalization of a cointegrated vector as a dependent variable is acceptable or not (Arslan and Yapraklı, 2008). In this context, before applying the Granger causality tests, we tested whether cointegrated variables are weak exogenous or not by using the Likelihood Ratio (LR) Test. Table 4 reports the results of weak exogenity tests.

The H0 null hypothesis: weak exogenity is rejected for all variables. These results indicate that all variables which are found cointegrated are internal variables and also verify the analysis of cointegration vectors where each sectoral IPE and EXPORTS are accepted as dependent variables because if a variable is weak exogenous, it is not included in the VECM model.

**Table 4:** Tests for Weak Exogenity

| Variables | Constraint vectors | LR Test ( $\chi^2$ ) | p-value |
|---|---|---|---|
| *XMANU* | $H_1'$ (1 0) | 18.00* | 0.000 |
| *IPEMANU* | $H_1'$ (1 0) | 16.63* | 0.000 |
| *XBMETAL* | $H_1'$ (1 0) | 13.32* | 0.000 |
| *IPEBMETAL* | $H_1'$ (1 0) | 13.28* | 0.000 |
| *XCHEM* | $H_1'$ (1 0) | 13.66* | 0.000 |
| *IPECHEM* | $H_1'$ (1 0) | 13.80* | 0.000 |
| *XELECT* | $H_1'$ (1 0) | 31.69* | 0.000 |
| *IPEELECT* | $H_1'$ (1 0) | 40.49* | 0.000 |
| *XMETALPROD* | $H_1'$ (1 0) | 8.97* | 0.003 |
| *IPEMETALPROD* | $H_1'$ (1 0) | 5.77** | 0.016 |

Note: (*)and (**) indicate that the corresponding coefficient is significant at 1% and 5% levels, respectively.

After finding a cointegration relationship between a series in terms of the Johansen method, an error correction model (ECM) will be employed, which includes an error correction term (ECT) (Engle and Granger, 1987; Taban and Aktar, 2008; Gries, Kraft and Meierrieks., 2009). In this context, ECMs are defined as in the equations (2) and (3) for each sector where variables represent IPE and EXPORTS for each sector.

$$\Delta Y_t = \alpha_1 + \sum_{i=1}^{m} \beta_{1i} \Delta Y_{t-i} + \sum_{i=1}^{n} \gamma_{1i} \Delta X_{t-i} + \sum_{i=1}^{r} \delta_{1i} ECT_{r,t-1} + u_t \quad (2)$$

$$\Delta X_t = \alpha_2 + \sum_{i=1}^{m} \beta_{2i} \Delta Y_{t-i} + \sum_{i=1}^{n} \gamma_{2i} \Delta Y_{t-i} + \sum_{i=1}^{r} \delta_{2i} ECT_{r,t-1} + v_t \quad (3)$$

If the joint of the coefficients of the independent variables are statistically significant, the H0 null hypothesis: “Y does not Granger cause X” will be rejected. The results of the short-run and long-run Granger causality test based on the VECM are given in Table 5.

**Table 5:** Granger Causality Test

| Variables | $ECT_{t-1}$ (t-statistics) | F statistics (prob) | RESULTS | |
|---|---|---|---|---|
| | | | Short Run | Long Run |
| *IPEMANU-XMANU* | -0.122 (-1.49) | 16.17 (0.00)* | *IPEMANU ↔ XMANU* | - |
| *XMANU- IPEMANU* | -0.116 (-3.24) | 30.89 (0.00)* | | *XMANU → IPEMANU* |
| *IPEBMETAL-XBMETAL* | 0.045 (1.16) | 8.23 (0.22) | - | - |
| *XBMETAL-IPEBMETAL* | -0.288(-4.10)* | 22.76(0.00)* | *XBMETAL → IPEBMETAL* | *XBMETAL → IPEBMETAL* |
| *IPECHEM-XCHEM* *XCHEM-IPECHEM* | -0.053 (-1.14) | 4.70(0.03)** | *IPECHEM→ XCHEM* | - |
| | -0.88(-3.45)* | 0.11 (0.74) | - | *XCHEM→ IPECHEM* |
| *IPEELECT-XELECT* | -0.582 (-6.40)* | 16.17 (0.00)* | *IPEELECT → XELECT* | *IPEELECT → XELECT* |
| *XELECT-IPEELECT* | 0.006(0.23) | 1.66 (0.19) | - | - |
| *IPEMETALPROD-XMETALPROD* | -0.068(-1.26) | 6.95(0.434) | - | - |
| *XMETALPROD-IPEMETALPROD* | -0.042(-1.86)*** | 7.35 (0.39) | - | *XMETALPROD → IPEMETALPROD* |

Note: (*), (**) and (***) indicate that the corresponding coefficient is significant at 1%, 5%, and 10% levels, respectively.

Following the detection of the cointegration relationship, we continue our analysis by testing the causality for these sectors. Test results indicate that there is at least one long-run relationship between variables. A uni-directional causality relationship was found from exports of the total manufacturing sector, basic metals, chemical products and fabricated metal products to each sector's IPE. This implies that exports cause economic growth in the long-run and provides empirical support for the export-led growth hypothesis for these sectors. A bi-directional causality relationship was found between IPEMANU and XMANU, which shows that exports of the total manufacturing industry and economic growth interact with each other in the short-run. The findings of the sub-sectors are different. As for the short-run, test results show that the direction of causality runs from XBMETAL to IPEBMETAL and confirms the export-led growth

hypothesis. However, in the short-run, growth-led exports is the case in the chemical products and electrical machinery and apparatus. A uni-directional causality relationship between IPEELECT and XELECT supports growth-led exports both in the long-run and short-run for electrical machinery and apparatus.

## 3. CONCLUSION

In this study, the relationship between EXPORTS and IPE as a proxy for economic growth were tested by employing a time series unit root, the Johansen cointegration and Granger causality tests for the total manufacturing sector and Turkey's top 10 exported goods for the period between 2002:01 and 2012:05. Johansen cointegration tests showed the existence of a long-run relationship only for the total manufacturing sector, basic metals, chemicals products, electrical machinery and apparatus and fabricated metal products. In the long run, the impact of exports on economic growth was found stronger than the impact of economic growth on exports for each sector. While the export-led growth hypothesis was found valid in the long-run for the manufacturing industry in the last decade of the Turkish economy, a feedback (bi-directional) relationship was found between exports and economic growth in the short-run. The findings of the sub-sectoral analysis differ from each other. Although we found evidence to support export-led growth for basic metals, chemical products and fabricated metal products in the long-run, a uni-directional causality relationship was found from economic growth to exports for electrical machinery and apparatus both in the short and long-run. Moreover, a growth-led export hypothesis was also found valid for chemical products in the short-run. Due to the fact that these sectors are more research and technology intensive (medium-high-technology industries) than the others (Mauro and Foster, 2008), the growth of the Turkish economy may also lead to an increase in exports in these sectors. However, causality tests are insufficient to analyze the extent of the impact of exports on economic growth in this context this should be further explored in another study.

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